

REMARKS

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Applicants respectfully traverse the rejections contained in the Office Action and request reconsideration in view of the amendments above and the remarks below.

Applicants' invention

Applicants' claimed invention includes adjacent first and second interconnects on an interconnect level, with spacers formed along adjacent sides thereof, and an air gap therebetween. The air gap extends above an upper surface of at least one of the interconnects. Applicant has amended claim 1 to incorporate the subject matter of claim 4, namely, that an etch stop layer is beneath at least one of the first and second interconnects, and that the air gap extends below a lower surface of the at least one of the first and second interconnects having the etch stop layer beneath by a distance corresponding to a thickness of the etch stop layer. Claim 4 has been cancelled.

Rejection on basis of Thomas et al. U.S. Patent No. 5,117,276

Claim 1 stands rejected under 35 USC § 102(b) as being anticipated by Thomas et al. U.S. Patent No. 5,117,276.

Thomas discloses in Fig. 2A interconnects 38 on an interconnect level, with a gap 53 between the interconnects. Unlike applicants' amended claim 1, neither interconnect 38 has an underlying etch stop layer. Consequently, air gap 53 does not extend below a lower surface of at least one of the interconnects 38 by a distance corresponding to an etch stop layer thickness. Thomas also does not suggest the use of such etch stop layer or corresponding air gap distance below an interconnect.

Accordingly, applicants' amended claim 1 is not anticipated by, or obvious from, the Thomas patent.

Rejection on basis of Grill et al. U.S. Patent No. 6,413,852

Claims 1-3 and 7-16 stand rejected under 35 USC § 102(b) as being anticipated by Grill et al. U.S. Patent No. 6,413,852. Claims 4-6 stand rejected under 35 USC § 103 as being obvious from Grill et al. in view of the Examiner's statements on pages 7 and 8 of the Office Action.

Grill discloses a multilevel interconnect structure in which air gap 270 lies between conductive lines 182. However, Grill does not disclose that the air gap extends above an upper surface of at least one of the conductive lines. A careful examination of Figs. 4C, 4D and 5D cited by the Examiner shows that the air gap does not extend above the upper level of either conductive line. It should be noted that the layer surrounding each conductive line is conductive material 170 (see Figs. 1D and 4B, and column 5, lines 33-37), which is itself functionally part of the conductive line. As for Figs. 5C and 5D cited by the Examiner in connection with claim 7, these figures "pertain to process steps related to dielectric sidewall spacer formation." Column 9, lines 46-47. As such, they do not disclose the final semiconductor device.

The Examiner has taken the position that the invention defined by previous claim 4 (now incorporated into claim 1) would have been obvious to one of ordinary skill in this art because in Grill "the diffusion barrier 170 and the etch stop layer 110 can be formed with respective thicknesses corresponding to each other, hence, the distance the air gap extending below the lower surface of the interconnects would be corresponding to the thickness of the etch stop layer, since such a modification would have involved a mere change in the size of a component." Office Action, p.8.

As stated above, feature 170 is a conductive material that lines the cavities in which the conductive lines are formed, and therefore become functionally part of the conductive lines. Grill's feature 110 is a dielectric material that is disclosed as being selected from a wide-ranging group of materials. Applicant disputes the contention that it would be obvious to make the dielectric material 110 the same thickness as the conductive material 170, to use the dielectric material 110 as an etch stop layer, and to make the air gap extend below the conductive line by such a distance. If the Examiner continues to believe that the limitation of claim 4 is obvious as stated, the applicants respectfully request that prior art be cited, or an affidavit entered into the record.

In view of the above, the Grill reference does not disclose or suggest the invention defined by applicants' claim 1 as amended.

Accordingly, applicants submit that claims 1-3 and 5-16 are not obvious from the cited prior art. It is respectfully submitted that the application has now been brought into a condition where allowance of the entire case is proper. Reconsideration and issuance of a notice of allowance are respectfully solicited.

Respectfully submitted,




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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service on the date indicated below as first class mail in an envelope addressed to the Mail Stop _____, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 2231301450.

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